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[FOURTH SERIES.]

"..... per litora spargite muscum,
Naiades, et circùm vitreos considite fontes:
Pollice virgineo teneros hìc carpite flores:
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo."
N. Parthenii Giannettasii Ecl. 1.

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I.—*Observations on a few Graptolites from the Lower Silurian Rocks of Victoria, Australia; with a Further Note on the Structure of* Ceratiocaris. By R. Etheridge, Jun., F.G.S.

[Plate III.]

The Silurian fauna of certain portions of the Palæozoic districts of South-eastern Australia, especially that of the colony of Victoria, is of peculiar interest, on account of the close relationship existing between it and that of a corresponding age in Great Britain. This was originally pointed out by Prof. M'Coy in a small pamphlet published for the Intercolonial Exhibition of 1861*, where he states that he had recognized numerous species of Graptolites in the rocks of the colony characteristic of beds of Lower Silurian age elsewhere. Amongst these were *Diplograptus pristis*, His., identical with specimens from the south of Scotland, *D. mucronatus*, Hall, and *D. ramosus*, Hall, similar to those of the Utica slate of New York, together with many double or twin Graptolites

* Intercolonial Exhibition Essays, 1861, "On the Ancient and Recent Natural History of Victoria;" also this Journal, 3rd series, 1862, vol. ix. p. 137.

from similar horizons. In addition to these Prof. M'Coy was also able to recognize characteristic Bala and May-Hill Sandstone (Upper Llandovery) fossils from several localities, extending over a considerable area. Furthermore, from the occurrence of the Trilobite *Phacops longicaudatus*, Murchison, the presence of the Wenlock-shale series was surmised, besides *Orthoceras bullatum*, a well-known Ludlow form, from beds on which a part of Melbourne itself stands.

The few forms of Graptolites here noticed were collected, some by my friend and former colleague, Mr. Norman Taylor, others by the latter gentleman and myself; whilst a few have since been received from Mr. G. H. F. Ulrich, through Mr. R. Daintree, to both of whom I am much indebted for them. The majority of the specimens are not in a good state of preservation.

Genus Tetragraptus, Salter.

Tetragraptus bryonoides, Hall. Pl. III. figs. 1–4*.

Graptolithus bryonoides, Hall, Grapt. Quebec Group, p. 84, t. 4. figs. 1–11.
?*Didymograptus caduceus*, Salter, Quart. Journ. Geol. Soc. 1855, ix. p. 87; *ibid.* 1863, xix. p. 137, fig. 13, *a*, *b*.
Didymograptus caduceus, M'Coy, Exhibition Essay, 1861, p. 161.
Tetragraptus bryonoides, Nicholson, Quart. Journ. Geol. Soc. 1868, xxiv. p. 131.

Frond consisting of four simple stipes, united in pairs at their bases, and connected by a short funicle of variable length, from the centre of which proceeds a short pointed radicle, &c. (*Hall*).

Of the Victorian forms of this species four figures are given. Fig. 1, the impression of a frond showing the four stipes flattened out, two broken off near the funicle, whilst on the other two the cast of the solid axis is well defined. Fig. 2 is a similar specimen, in which the whole of the four stipes are displayed, but here, again, two more perfect than the others. These two specimens have the stipes somewhat wider than in the figures of this species given by Hall; they present a certain resemblance to *G. Bigsbyi*, Hall, which I find Prof. Nicholson considers hardly separable from *D. caduceus*, Salter, or *T. bryonoides*, Hall ('Annals,' 1870, v. p. 348). Figs. 3 & 4 are the more common forms under which this species is found in Victorian rocks, and exactly coincide with that described and figured by Salter as *Didymograptus caduceus*. I have placed this above as a synonym of *T. bryo-*

* In drawing these figures, one of the specimens was unfortunately placed the wrong way up; the stipes should be represented looking downwards.

noides, more in deference to the opinion of others better versed in this difficult group than myself; but nevertheless the examination of many Australian specimens has shown the position of the two stipes and "apparent radicle" to be so constant, that I am led to the conclusion that we should pause before finally considering the two species synonymous. At any rate, if they are one and the same, I think Salter's name might with advantage be retained as a varietal designation for such forms as those represented by figs. 3 & 4.

T. bryonoides is characteristic of the Quebec group in America and the Skiddaw group of the north of England.

Localities. Watchbox Ranges, near Baynton's, county of Dalhousie, in blue shale; collected by Mr. N. Taylor. Castlemaine, county of Talbot, in chocolate shale; collected by Mr. G. H. F. Ulrich. Mainroad Gully, Mia-Mia, Spring Plains, Redesdale, county of Dalhousie, in red and white sandy shale; collected by Mr. N. Taylor and the writer.

Tetragraptus quadribrachiatus, Hall. Pl. III. figs. 5–8.

Graptolithus quadribrachiatus, Hall, Grapt. Quebec Gr. p. 91, t. 5. figs. 1–5, t. 6. figs. 5, 6.
Tetragraptus crucialis, Salter, Quart. Journ. Geol. Soc. 1863, xix. p. 137, fig. 8 *b*.
—— *quadribrachiatus*, Nicholson, Quart. Journ. Geol. Soc. 1868, xxiv. p. 131; M'Coy, Exhibition Essay, 1861, p. 161.

Frond composed of four simple undivided stipes arranged bilaterally, or two proceeding from each extremity of the funicle &c. (*Hall.*)

The specimens represented by figs. 5, 6, 7, & 8 I have referred to this species. The stipes appear to be somewhat wider than in those figured by Hall (but this may perhaps be due to pressure), and the funicle slighter.

This species is characteristic of the Quebec and the Skiddaw series.

Localities. Watchbox Ranges, near Baynton's, county of Dalhousie, in blue shale; Newham, near Lancefield, county of Bourke. Collected by Mr. N. Taylor.

Genus Phyllograptus, Hall.

Phyllograptus typus, Hall. Pl. III. figs. 9, 10.

Phyllograptus typus, Hall, Grapt. Quebec Group, p. 119, pl. 15. figs. 1–12; M'Coy, Exhibition Essay, 1861, p. 161; Nicholson, Quart. Journ. Geol. Soc. 1868, xxiv. p. 133, pl. 5. fig. 16.

Stipes robust, composed of four semielliptical parts joined by their straight sides. In some specimens of this species

the linear central axis is often crenulate from the bases or impressions of cellules of the other division, which is rectangular to that part of the frond preserved. (*Hall.*)

Numerous specimens of this handsome Graptolite are in my possession from the under-mentioned locality. These show elongato-ovate to obovate form; but in none is the radicle well preserved, and the crenulate axis or midrib only faintly so—except in one specimen, where the latter is sufficiently exposed to demonstrate the specific affinities of the specimens. Hall mentions that the cellules are obscure at the margins; but in the Australian specimens before me these are moderately well marked and almost denticulate. The largest specimen measures 1 inch in length by about $3\frac{1}{2}$ lines in width.

P. typus is a typical Quebec and Skiddaw species.

Locality. Newham, near Lancefield, county of Bourke, in blue shale; collected by Mr. N. Taylor.

Genus Loganograptus, Hall.

Loganograptus Logani, Hall. Pl. III. figs. 11 & 12.

Graptolithus Logani, Hall, Grapt. Quebec Group, p. 100, t. 9. figs. 1–9, and t. 11. fig. 7; M'Coy, Exhibition Essay, 1861, p. 161.

Dichograptus Logani, Nicholson, Quart. Journ. Geol. Soc. 1868, xxiv. p. 128.

Loganograptus Logani, Hall, Twentieth Annual Report, State Cab. New York, 1867, p. 226; Nicholson, Monograph Brit. Grapt. 1872, pt. i. p. 110.

The imperfect specimens represented by figs. 11 & 12 are the only ones in my possession, although far finer have been obtained from various localities in the colony, and are, I believe, in the geological collection of the National Museum, Melbourne. Only a little more than half the specimen (fig. 11) is preserved. There is no evidence of a disk; and the state of preservation is not sufficiently good to show the true characters of the cellules. Fig. 12 is also an imperfect specimen, and, so far as I can judge, is an individual of the present species, although there are only eleven stipes preserved. No disk is apparent; but for some little distance around the funicle the matrix is discoloured, or rather has assumed a lighter colour, approaching that of those parts of the organism preserved.

L. Logani is recorded from both the Quebec and Skiddaw series.

Localities. Newham, near Lancefield, county of Bourke, in blue shale; collected by Mr. N. Taylor. Mainroad Gully, Mia-Mia, Spring Plains, Redesdale, county of Dalhousie, in red sandy shale; collected by Mr. N. Taylor and the writer.

Genus Climacograptus, Hall. Pl. III. fig. 13*.

On a few pieces of shale accompanying *Tetragraptus quadribrachiatus*, and a few other forms, are fragments probably referable to this genus. In one of these (fig. 13) the cellules appear as transverse openings down the right-hand side of the scalariform impression. There is likewise a faint indication of the extension of the axis at the proximal end.

Locality. Newham, near Lancefield, county of Bourke; collected by Mr. N. Taylor.

Genus Diplograptus, M'Coy.

Diplograptus mucronatus, Hall. Pl. III. figs. 14–17.

Graptolithus mucronatus, Hall, Pal. New York, 1847, i. p. 268, t. 73. fig. 1, *a–d*.

Diplograptus mucronatus, Salter, Mem. Geol. Surv. 1866, iii. p. 330, t. 11 a. fig. 6, t. 12. fig. 1; M'Coy, Exhibition Essay, 1861, p. 161; Nicholson, Quart. Journ. Geol. Soc. 1868, xxiv. p. 139.

Prof. Nicholson recorded this characteristic Upper Llandeilo Graptolite as occurring in the Skiddaw series as far back as 1868; it therefore becomes a very interesting point to find it in company, in Victorian rocks, with other genera and species indicative of the same beds, such, for instance, as *T. quadribrachiatus*, *P. typus*, *T. bryonoides*, &c. Figs. 14 & 15 represent a specimen showing the distal extension of the central axis and the long slender processes from the cells. In figs. 16 and 17 may be noticed the peculiar marginal fibres, considered by Hall as giving attachment to the reproductive sacs. Furthermore these fibres are more or less anastomosing, forming a network similar to instances mentioned by Mr. Carruthers in specimens from Moffat, and by Mr. Baily from Meath†. The former remarks, "It is not easy to determine how far the processes from the mouths of the hydrothecæ are to be depended upon for specific characters," but would propose for such forms as the present, should the anastomosing nature of the fibres be of sufficient importance, the specific name of *D. Bailyi*.

D. mucronatus is recorded from the Upper Llandeilo beds of Moffat (*Carruthers*), Lower Llandeilo beds of Wales (*Salter*), Skiddaw series of the north of England (*Nicholson*), Hudson-River group of Albany, U.S. (*Hall*), and has been recorded by Prof. M'Coy from Victoria.

Localities. Watchbox Ranges, near Baynton's, county of Dalhousie, and Newham, near Lancefield, county of Bourke, both in blue micaceous shale; collected by Mr. N. Taylor.

* The figure of this specimen should also be reversed.

† Geol. Mag. v. p. 131.

Diplograptus pristis, Hisinger. Pl. III. fig. 18.

I have referred fig. 18 to this species with some hesitation. There are a series of notch-like projections down each side the stipe, evidently the denticles of the cellules; and the distal extremity is prolonged and expanded into the small globular body or vesicle often met with in some species of this genus. *D. pristis* has previously been recorded from Victorian rocks by Prof. M'Coy*.

Locality. Newham, near Lancefield, county of Bourke, in blue micaceous shale; collected by Mr. N. Taylor.

Genus Didymograptus, M'Coy.

Didymograptus? fruticosus, Hall. Pl. III. fig. 19.

Graptolithus fruticosus, Hall, Grapt. Quebec Group, p. 90, t. 5. figs. 6–8, t. 6. figs. 1–3.

Frond consisting of two pairs of ascending and slightly curved stipes, arising from the two sides of a long slender radicle. The stipes are celluliferous on the inner or adjacent margin, little divergent at the bifurcation, and continuing for half or two thirds their length nearly straight; above this they curve gently outwards . . . . . Radicle half an inch in length. Cellules short and broad . . . . Aperture wide, apex pointed, scarcely mucronate, and sometimes acutely rounded. (*Hall.*)

I was for some time in great doubt to what species to refer this form; but its chief characters appear to approach those of *D.?* (*Grapt.*) *fruticosus*, Hall, nearer than any other, although three only of the four stipes are preserved. A definite attachment is to be seen between the two remaining right-hand stipes, the second of the opposite side having probably been removed through injury. The cellules are broad, with a wide aperture and pointed apex, which projects without becoming mucronate. The radicle is not as long as it should be in this species, according to Hall's description.

Quebec group.

Locality. Castlemaine, county of Talbot, in hard black shale; collected by Mr. G. H. F. Ulrich.

Didymograptus nitidus, Hall. Pl. III. fig. 20.

Graptolithus nitidus, Hall, Grapt. Quebec Group, p. 69, t. 1. figs. 1–9.
Didymograptus nitidus, Salter, Quart. Journ. Geol. Soc. 1863, xix. p. 137, fig. 13, *d*; Nicholson, *ibid.* 1868, xxiv. p. 135.

Frond composed of two simple stipes proceeding from a

* Exhibition Essay, 1861, p. 161.

small radicle, and diverging at an angle of about 170°. Stipes narrower at the base, and gradually widening towards the extremities. Radicle short, abruptly tapering to a point. (*Hall.*)

The specimen I have figured as this species appears to correspond in form and number of cellules with Hall's species. It likewise has some resemblance to Hall's *D.* (*Grapt.*) *patulus*; but the angle of divergence is less than in that species. It is both a Quebec and Skiddaw form.

Locality. Castlemaine, county of Talbot, in chocolate-coloured shale; collected by Mr. G. H. F. Ulrich.

Didymograptus Pantoni?, M'Coy. Pl. III. figs. 21 & 22.

Graptolithus Pantoni (M'Coy), Salter, Quart. Journ. Geol. Soc. 1863, xix. p. 138 (without description).

To the specimens from which figs. 21 & 22 were drawn, I have provisionally given the name of *Didymograptus Pantoni*, M'Coy. I am not acquainted with any description or figure of this Graptolite; but, from a certain resemblance the specimens bear to Mr. Salter's *D. v-fractus*, which he considered like Professor M'Coy's *G. Pantoni*, I have, as before stated, provisionally given that name to them. Fig. 21 shows two stipes placed in juxtaposition, with the union of the two with the radicle wanting. Fig. 22 represents one stipe and a small portion of the other, and enables us to judge of their angle of divergence from the radicle, which appears to be much less than that of Salter's figure of *D. v-fractus*, and still less than Nicholson's representation of the same species*. That *D. v-fractus*, Salter, and *D. Pantoni*, M'Coy, are identical, I am not at all prepared to say; the great difference in the angle of divergence of the stipes would appear to separate them, of course presuming the specimens here figured to be the latter species. Should they be proved to be identical, Prof. M'Coy's name would have priority. The number of cellules in a given space in *D. v-fractus* and our present species does not correspond, being greater in the former, so far as an opinion can be formed from figures only.

Locality. Mainroad Gully, Mia-Mia, Spring Plains, Redesdale, in red shale; collected by Mr. N. Taylor and the writer.

Genus Graptolithus, Linnæus.

Graptolithus latus, M'Coy†. Pl. III. fig. 23.

The fragmentary Graptolites referred to under this name

* Mon. Brit. Grapt. 1872, pt. i. p. 104, fig. 48.

† Quart. Journ. Geol. Soc. iv. p. 223; also Brit. Pal. Foss. p. 4, t. 1 B. fig. 7 *a*, *b*, *c*.

are now generally regarded as portions of other more complex species, such as *Dichograptus octobrachiatus*, *Didymograptus patulus*, Hall, and others. Prof. Nicholson remarks that, "while not representing a true species, the name may be usefully retained as a convenient designation for the numerous specimens which are too fragmentary to admit of specific or generic determination" *. Such a fragment appears to be the stipe (fig. 23) provided with the triangular submucronate denticles of this so-called species. *G. latus* is recorded as a Victorian species by Prof. M'Coy †.

Localities. Watchbox Ranges, near Baynton's, county of Dalhousie, and Newham, near Lancefield, county of Bourke, in blue micaceous shale; collected by Mr. N. Taylor.

Graptolithus, sp. Pl. III. fig. 24.

In this specimen the cellules do not all retain their normal outline. It is probably only a portion of a stipe of a more complex form. Professor M'Coy ‡ has recognized *G. tenuis*, Portlock, as accompanying other simple Graptolites in Victorian beds; it may be a variety of this.

Locality. Newham, in blue shale; collected by Mr. N. Taylor.

Discarding for the moment the form I have here introduced as *Didymograptus Pantoni* (?), M'Coy, we find that the majority of the foregoing species are particularly characteristic of the Quebec and Skiddaw groups.

Diplograptus mucronatus is considered in this country to be chiefly an Upper Llandeilo species, but at the same time has been placed as a member of the Skiddaw fauna by Prof. Nicholson §. Its occurrence in Victoria with such truly Quebec and Skiddaw species as here shown will, in some degree, tend to confirm this.

Grouping the species recorded in this communication under their respective localities, we find that they range themselves thus :—

Watchbox Ranges, Baynton's: *Tetragraptus bryonoides*, Hall (*D. caduceus*); *T. quadribrachiatus*, Hall; *Diplograptus mucronatus*, Hall; *Graptolithus latus*, M'Coy.

Newham, near Lancefield: *Tetragraptus quadribrachiatus*, Hall; *Phyllograptus typus*, Hall; *Loganograptus Logani*, Hall; *Climacograptus* ?, sp.; *Diplograptus mucronatus*, Hall; *D.*

* Quart. Journ. Geol. Soc. xxiv. p. 141.
† Exhibition Essay, 1861, p. 161.
‡ *Loc. cit.*
§ Quart. Journ. Geol. Soc. 1868, xxiv. p. 139.

pristis ?, Hisinger; *Graptolithus latus*, M'Coy; *Graptolithus*, sp. (? *G. tenuis*, Portlock).

Castlemaine: *Tetragraptus bryonoides*, Hall; *Didymograptus* (?) *fruticosus*, Hall; *D. nitidus*, Hall.

Redesdale (Spring Plains): *Tetragraptus bryonoides*, Hall; *Loganograptus Logani*, Hall; *Didymograptus Pantoni* ?, M'Coy.

Further Note on the Structure of Ceratiocaris.

At the Brighton Meeting of the British Association* Mr. H. Woodward, F.R.S., noticed the discovery of the "swimming-gills" of *Ceratiocaris*, to which I had previously drawn his attention. On a slab of thin flaggy shale from the Upper Silurian series of Lesmahagow are exposed the caudal segments, telson, and caudal appendages of a *Ceratiocaris*. From the ventral margin of the terminal segment proceeds a broad paddle-shaped membranous (?) expansion, presenting a strong marginal outline, with a transversely striated surface. This is followed by another similar appendage, proceeding in the same manner from the penultimate segment. The dorsal edge of the specimen shows that one of the corresponding "foot-gills" of the opposite side has been bent back upon itself, and thus thrust out of place. The free ends of these paddle-shaped appendages are attenuated to more or less rounded points. They do not show any evidence of a marginal fringe. These gill-feet are no doubt analogous to the same supplementary abdominal organs in *Nebalia*.

Locality. Linn Burn, about two miles north of Muirkirk, Lanarkshire, in thin flaggy shale. Collection of the Geological Survey of Scotland. Collected by Mr. A. Macconochie.

EXPLANATION OF PLATE III.

Figs. 1 & 2. *Tetragraptus bryonoides*, Hall. Spring Plains, Redesdale, Victoria.

Figs. 3 & 4. *Tetragraptus bryonoides*, Hall (*D. caduceus*, Salter). Watchbox Ranges, near Baynton's, county of Dalhousie, Victoria.

Fig. 5. *Tetragraptus quadribrachiatus*, Hall. Watchbox Ranges, near Baynton's.

Figs. 6–8. *Tetragraptus quadribrachiatus*, Hall. Newham, near Lancefield, county of Bourke, Victoria.

Figs. 9 & 10. *Phyllograptus typus*, Hall. Newham, near Lancefield.

Fig. 11. *Loganograptus Logani*, Hall. Spring Plains, Redesdale, Victoria.

Fig. 12. *Loganograptus Logani* ?, Hall. Newham, near Lancefield.

Fig. 13. *Climacograptus* ?, sp. Newham, near Lancefield.

Figs. 14 & 15. *Diplograptus mucronatus*, Hall. Watchbox Ranges, near Baynton's, county of Dalhousie.

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* Brit. Assoc. Report, 1872, p. 323; also Mem. Geol. Survey, Explanation 23. Scotland, p. 93.

Fig. 16. *Diplograptus mucronatus*, Hall, with marginal fibres. Newham, near Lancefield.
Fig. 17. *Diplograptus mucronatus*, Hall, with marginal fibres. Watchbox Ranges, near Baynton's.
Fig. 18. *Diplograptus pristis*?, Hisinger. Newham, near Lancefield. The cellules are somewhat too distinctly represented in this figure.
Fig. 19. *Didymograptus*? *fruticosus*, Hall. Castlemaine, county of Talbot. Three only of the four stipes are here seen.
Fig. 20. *Didymograptus nitidus*, Hall. Castlemaine.
Fig. 21. *Didymograptus Pantoni*?, M'Coy. Spring Plains, Redesdale. Showing the upper portion of two stipes.
Fig. 22. *Didymograptus Pantoni*?, M'Coy. Spring Plains, Redesdale. Showing one stipe, and portion of the other, with radicle.
Fig. 23. *Graptolithus latus*, M'Coy. Watchbox Ranges, near Baynton's.
Fig. 24. *Graptolithus tenuis*?, Portlock. Newham, near Lancefield.

Note.—The figures are all drawn as near as possible to the natural size. I am much indebted to my friend Mr. B. N. Peach for his careful delineation of the specimens.

II.—*Amphipodous Crustacea. A new Species, and some Items of Description and Nomenclature.* By the Rev. T. R. R. Stebbing, M.A.

[Plates I. & II.]

Liljeborgia Normanni, n. sp. Pl. I. figs. 1, 1 *a*, 1 *b*, 1 *c*.

This species comes very near to *Liljeborgia shetlandica*, discovered by the Rev. A. M. Norman; and I have taken the liberty of naming it in honour of that very distinguished carcinologist. Both pairs of gnathopoda agree very closely with the figures and descriptions given by Bate and Westwood of those members in *L. shetlandica*. In the first pair, however, the finger of the new species is longer, and has a serrated edge; in the second pair the hand, instead of being only fringed with hair, is very prettily covered with it. The coxæ of the fifth and sixth pairs of legs are deeper than those figured for *L. shetlandica*; and the thighs of the fifth pair, instead of being equal to those of the sixth and seventh, are considerably smaller.

The lenses of the eyes are not numerous, though the eyes are large—which accords with the description given of the genus, though the eyes of *L. shetlandica* are stated to be small. The magnitude of the eyes is in many species of sessile-eyed Crustacea a very variable character.

The head has a rather deep slit below the lobe on which